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FOR: MOTOR ASSEMBLED BY USING MOTOR-BASE-HOLDER AND METHOD OF ASSEMBLING THE SAME MOTOR

VERIFICATION OF A TRANSLATION

Assistant Commissioner for Patents
Washington, D.C. 20231
SIR :

I, the below named translator, hereby declare that:

1. My name and post office address are as stated below.

2. That I am knowledgeable in the English language and in the language of JPH11-351296, and I believe the attached English translation to be a true and complete translation of JPH11-351296.

The document for which the attached English translation is being submitted is a patent application on an invention entitled MOTOR ASSEMBLED BY USING MOTOR-BASE-HOLDER AND METHOD OF ASSEMBLING THE SAME MOTOR

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Date: June 13, 2002

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[Title of the Invention] Brush-less Motor and Method of Assembling the Same Motor

[What is Claimed is]

[Claim 1] A motor-base-holder comprising:

a motor base including:

a base shaping in a substantially flat plate;

a bearing supporter protruded vertically from approx. a center of said base for supporting a bearing;

a stator supporter concentric with said bearing supporter for being mounted with a stator;

a plurality of terminals made of metal plate and insert-molded around said bearing supporter; and

a metal frame made of identical material to the terminals and linked with fringe of said motor base.

[Claim 2] A motor-base-holder comprising:

a motor base including:

a base shaping in a substantially flat plate;

a bearing supporter protruded vertically from approx. a center of said base for supporting a bearing;

a stator supporter concentric with said bearing supporter for being mounted with a stator;

a plurality of terminals made of metal plate and insert-molded around said bearing supporter; and

a metal frame made of identical material to the terminals and for linking fringes of a plurality of said motor bases together.

[Claim 3] A motor-base-holder comprising:

a motor base including:

a base shaping in a substantially flat plate;

a bearing supporter protruded vertically from approx. a center of said base for supporting a bearing;

a stator supporter concentric with said bearing supporter for being mounted with a stator;

a plurality of terminals made of metal plate and insert-molded around said bearing supporter; and

a metal frame made of identical material to the terminals and for linking fringes of a plurality of said motor bases together to form a belt-like holder.

[Claim 4] The motor-base-holder of claim 3, wherein said motor bases and said metal frame are linked in a width direction of the belt-like holder, and adjacent said motor bases are separated in a longitudinal direction.

[Claim 5] A method of assembling a brush-less motor using the motor-base-holder as defined in one of claims 1 through 3, a stator assembly and a rotor, said method comprising the steps of:

positioning and supporting a motor base of the motor-base-holder at a given place by a metal frame;

assembling the stator assembly and the rotor of the motor to the motor base; and

detaching the motor base from the metal frame.

[Claim 6] A brush-less motor comprising:

a motor base including:

a base shaping in a substantially flat plate;

a bearing supporter protruded vertically from approx. a center of said base for supporting a bearing;

a stator supporter concentric with said bearing supporter for being mounted with a stator;

a plurality of terminals made of metal plate and insert-molded around said bearing supporter;

a plurality of perforations for separating a metal frame from said motor base, said perforations being disposed dispersedly around said motor base.

[Claim 7] A brush-less motor comprising:

a stator assembly including a stator core;

a motor base including:

a base shaping in a substantially flat plate;

a bearing supporter protruded vertically from approx. a center of said base for supporting a bearing;

a stator supporter concentric with said bearing supporter and for being mounted with said stator assembly;

a stator fixer extended from said stator supporter exceeding a thickness of the stator core;

a bushing for mating with said stator fixer;

wherein the stator core of said stator assembly is inserted into said stator supporter, then said bushing is mated with said stator fixer, so that said stator assembly is fixed.

[Claim 8] A brush-less motor comprising:

a motor base including:

a base shaping in substantially a flat plate;

a bearing supporter protruded vertically from approx. a center of said base for supporting a bearing;

a plurality of terminals made of metal plate, made by insert-molding and disposed around said bearing supporter;

a rotor supported by the bearing which is supported by said bearing supporter; and

a metal cover for covering said rotor,

wherein a plurality of metal tips extending outside of said motor base are formed, and an end of said cover is fixed to the metal tips.

[Claim 9] The motor as defined in Claim 8, wherein the end of said metal cover is fixed to the metal tips by welding.

[Claim 10] The motor as defined in Claim 8, wherein the end of said cover is fixed to the metal tips by engaging and deforming thereof.

[Detailed Description of the Invention]

[0001]

[Field of the Invention]

The present invention relates to a brush-less motor, and more particularly, relates to a technique improving the productivity thereof. The present invention is suitable to an ultra-micro motor employed in cellular phones as a vibration motor.

[0002]

[Prior Art]

A brush-less motor with a core used in information devices comprises the following elements in general:

a metal base;

a bearing, a printed circuit board, and a stator assembly mounted to the metal base;

a cylindrical rotor magnet mounted on an outer or inner wall of the stator core, thereby facing the magnet to the stator core.

When a motor has a certain size, this structure is easy to assemble; however, downsizing the motor increases difficulties of assembling and lowers the productivity, because assembling machines or operators' finger-tips cannot access to inside or even cannot access close to the motor.

[0003]

Japanese Patent Laid-Open Application No. H10-127031 addresses the problem discussed above. Fig. 10 illustrates an embodiment of this prior art.

In Fig. 10, metal wired-board 14 is buried in base 24 made of synthetic resin for maintaining the insulation. A first end of board 14 extends over an upper end of base 24 as riser 40, and a second end is exposed as a connector terminal. This structure aims to simplify a work of connecting terminal 42 of winding 18 coiled on stator core 20 to riser 40.

[0004]

However, downsizing the motor reveals a problem, i.e. elements of the motor are hard to handle for workers. For instance, a motor of 10 mm across gives the workers a difficulty to handle its components quickly. Further downsizing of the motor requires severer mating allowances between the components. This increases the difficulty of assembling the components into a motor. As such, the productivity is traded off for downsizing the motor. A breakthrough method of this problem has been enthusiastically demanded.

[0005]

In addition to these problems of handling and mating allowance, a section bonded with another section or a section undergone resin-welding needs time before it is fixed. Shortening this waiting time has been also demanded. This is also a problem to be solved.

[0006]

[Problems to be Solved by the Invention]

The present invention addresses the problems discussed above, and aims to provide a motor having a structure realizing high productivity as well as a method of assembling the same motor by solving problems such as difficulty of handling, severity of mating, time-consuming of bonding or welding.

[0007]

[Means to Solve the Problems]

In order to solve the foregoing problems, a motor-base-holder is adopted for assembling the brush-less motor of the present invention. This motor-base-holder is a metal frame made of the same material as terminals and connected to an outside of a motor-base.

[0008]

In an assembling method of the motor, the motor-base-holder, a stator assembly and a rotor both of which are to be assembled to the motor-base-holder, are used. The assembling method comprises the steps of: (a) positioning and supporting the motor base of the motor-base-holder at a given place with the metal frame; (b) assembling the stator assembly and the rotor to the motor base; and (c) detaching the motor base from the metal frame.

[0009]

The brush-less motor of the present invention comprises the following element:

a motor base including:

a base shaping in a substantially flat plate;

a bearing supporter protruded vertically from approx. a center of the base for supporting a bearing;

a stator supporter concentric with the bearing supporter for being mounted with a stator;

a plurality of terminals made of metal plate and insert-molded around the bearing supporter;

a plurality of perforations for separating a metal frame from the motor base, the perforations being disposed dispersedly around the motor base.

[0010]

[Description of the Preferred Embodiment]

An invention disclosed in claim 1 relates to a motor-base-holder, which comprises the following elements:

(a) a motor base including:

a base shaping in a substantially flat plate;

a bearing supporter protruded vertically from approx. a center of the base for supporting a bearing;

a stator supporter concentric with the bearing supporter for being mounted with a stator;

a plurality of terminals made of metal plate and insert-molded around the bearing supporter; and

(b) a metal frame made of identical material to the terminals and linked with a fringe of the motor base.

A metal frame made of the same material as the terminals is connected to the fringe of the motor base. The metal frame and the terminals are produced by punching a sheet of metal at the same time, and the metal

frame supports a positioning of the motor base. Thus the motor base of compact size can be accurately positioned, and handled with ease because of the presence of the metal frame. Bridges that connect the metal frame to the motor base are preferably disposed around the motor base dispersedly because this structure strengthens the support and reduces anisotrophy in displacement.

[0011]

An invention disclosed in claim 2 relates to a motor-base-holder, which comprises the following elements:

(a) a motor base including:

a base shaping in a substantially flat plate;

a bearing supporter protruded vertically from approx. a center of the base for supporting a bearing;

a stator supporter concentric with the bearing supporter for being mounted with a stator;

a plurality of terminals made of metal plate and insert-molded around the bearing supporter; and

(b) a metal frame made of identical material to the terminals and for linking fringes of a plurality of the motor bases together.

The link of the fringes of a plurality of the motor bases with the metal frame allows users to handle the motor bases of micro-motors with ease, so that the time required to handling the motors can be shortened.

[0012]

An invention disclosed in claim 3 relates to a motor-base-holder, which comprises the following elements:

(a) a motor base including:

a base shaping in a substantially flat plate;

a bearing supporter protruded vertically from approx. a

center of the base for supporting a bearing;

a stator supporter concentric with the bearing supporter for being mounted with a stator;

a plurality of terminals made of metal plate and insert-molded around the bearing supporter; and

(b) a metal frame made of identical material to the terminals and for linking fringes of a plurality of the motor bases in a belt-like manner together.

The link of the fringes of a plurality of the motor bases with the metal frame in a belt-like manner allows a manufacturer to assemble the motor-base-holders automatically and continuously. This assembling method can simplify a transport mechanism, and realizes compact and inexpensive assembly equipment.

[0013]

An invention disclosed in claim 4 relates to the motor-base-holder of claim 3. The plural motor bases are linked with the metal frame in a width direction of a belt-like holder, and adjacent motor bases are separated in a longitudinal direction. Since the adjacent motor-bases are separated in the longitudinal direction, the motor base hardly incurs bending stress when being rolled on a reel. Thus the resin is prevented from creeping during the storage of the motor bases.

[0014]

An invention disclosed in claim 5 relates to a method of assembling the motor-base-holder of any one of claim 1 through claim 3. The method uses (a) the motor-base-holder as defined in one of claims 1 through 3, a stator assembly and a rotor, and the method comprises the following steps (b):

positioning and supporting the motor base of the motor-base-holder at a given place by the metal frame;

assembling the stator assembly and the rotor of the motor to the motor base; and

detaching the motor base from the frame.

The motor base is positioned and supported by the motor-base-holder for being assembled. For the positioning, the metal frame of excellent accuracy of form is used, so that highly accurate positioning is expected rather than using resin material. An ultra-micro motor that requires severe mating allowances badly needs this effective method.

[0015]

Further, since the metal frame supporting the motor base is elastically deformed and also the bearing supporter protrudes from the base section, centering action is produced between the shaft and the bearing when the rotor is inserted. This centering action greatly contributes to improving the productivity of the motor.

[0016]

An invention disclosed in claim 6 relates to a brush-less motor, which comprises the following elements:

(a) a motor base including:

a base shaping in a substantially flat plate;

a bearing supporter protruded vertically from approx. a center of the base for supporting a bearing;

a stator supporter concentric with the bearing supporter for being mounted with a stator;

a plurality of terminals made of metal plate and insert-molded around the bearing supporter;

(b) a plurality of perforations for separating a metal frame from the motor base, the perforations being disposed dispersedly around the motor base.

Since the metal frame and plural perforations are dispersedly disposed around the motor base, this structure is well suited for assembling the motor base by positioning and supporting using the metal frame.

[0017]

An invention disclosed in claim 7 relates to a brush-less motor, which comprises the following elements:

(a) a stator assembly including a stator core;

(b) a motor base including:

a base shaping in a substantially flat plate;

a bearing supporter protruded vertically from approx. a center of the base for supporting a bearing;

a stator supporter concentric with the bearing supporter and for being mounted with the stator assembly;

a stator fixer extended from the stator supporter exceeding a thickness of the stator core; and

(c) a bushing for mating with the stator fixer.

(d) The stator core of the stator assembly is inserted into the stator supporter, then the bushing is mated with the stator fixer, so that the stator assembly is fixed.

Since the stator assembly is fixed by press-fitting the bushing into the stator fixer, a holding time for fixing is much less than using bonding or resin-welding.

[0018]

An invention disclosed in claim 8 relates to a brush-less motor, which comprises the following elements:

(a) a motor base including:

a base shaping in substantially a flat plate;

a bearing supporter protruded vertically from approx.

a center of the base for supporting a bearing;

a plurality of terminals made of metal plate, made by insert-molding and disposed around the bearing supporter;

(b) a rotor supported by the bearing which is supported by the bearing supporter; and

(c) a metal cover for covering the rotor.

(d) Plural metal tips extending outside of the motor base are formed, and (e) an end of the cover is fixed to the metal tips.

Since the end of the cover is fixed to the metal tips, an electrical coupling therebetween is achievable. The metal tips are grounded, thereby shielding electromagnetic noises produced by the motor. This connection between metals requires only a small space and yet produces a great bonding power.

[0019]

An invention disclosed in claim 9 relates to the brush-less motor of claim 8. An end of the cover is fixed to the metal tips of the motor base is fixed by welding. Welding metal material requires less time for solidifying and smaller space than welding resin material.

[0020]

An invention disclosed in claim 10 relates to the brush-less motor of claim 8. The end of the cover is fixed to the metal tips by engaging and deforming thereof. Metal material is easy to be plastic-deformed and maintains the strength after the plastic deformation, therefore, there is no need to wait solidification as in the case of welding resin material.

[0021]

[Exemplary Embodiment]

Exemplary embodiments of the present invention are demonstrated hereinafter with reference to the accompanying drawings.

[0022]

(Exemplary Embodiment 1)

Fig. 1 is a sectional view illustrating a structure of a motor in accordance with the first embodiment. Fig. 2 shows an appearance of the motor, (a) is a top view, (b) is a lateral view and (c) is a bottom view.

[0023]

Fig. 3 shows a shape of a motor base, (a) is a plan view, (b) is a lateral sectional view. Fig. 4 is a plan view illustrating a motor base assembly, and shows a status of the motor base linked with a metal frame. Fig. 5 is an exploded lateral view of the elements constituting the motor.

[0024]

In Fig. 1, the motor comprises a stator (non-rotating section), a rotor (rotating section) and a cover. The rotor includes rotor frame 1100 as a major part and ring-shaped magnet 1200 mounted to an inner wall of rotor frame 1100, and further, eccentric weight 1300 is mounted to frame 1100. The rotor revolves on shaft 1400 mounted at the center thereof.

[0025]

The stator includes motor base 3101 as a major part. Stator assembly 2000 is formed of stator core 2100, wire terminating member 2200, and winding 2300, and is mounted to base 3101. Terminal 3111 of base 3101 is coupled to winding's terminal 2310. Shaft 1400 is jounaled by metal 3200, and cover 3401 covers the rotor.

[0026]

An appearance of the motor used in this first embodiment shows, as illustrated in Fig. 2(a), circular cover 3401 on polygonal motor-base 3101. As shown in Fig. 2(b), cover 3401 has some protrusions 3411 and 3421 extended to base 3101. Some of the protrusions extend to as deep as a lower end of base 3101, and the other are coupled with metal tip 3121 extended from a side face of base 3101. On the bottom face of base 3101, six

terminals 3111 are exposed as shown in Fig. 2(c). These exposed terminals can be coupled with a board (not shown) of a device on which the motor is mounted by re-flow soldering. This coupling allows terminals 3111 to carry electric current from the device board to the stator windings, thereby spinning the rotor. Then eccentric weight 1300 mounted to the rotor produces vibrations to make the device vibrate.

[0027]

Since the present invention relates to a structure of a motor base, the motor base is detailed hereinafter.

[0028]

Fig. 3 shows a shape of the motor base. As shown in Fig. 3(b), motor-base 3101 is made of resin molded, and comprises substantially flat base 3131, bearing supporter 3141 protruding vertically from the center of base 3131 for supporting the bearing, and stator supporter 3151 concentric with the bearing supporter and for being mounted with the stator. On the base section, as shown in Fig. 3(a), six terminals 3111 are disposed around bearing supporter 3141. These terminals 3111 are made of metal plate and insert-molded into the base section. The upper face of terminals 3111 works as a connecting terminal for being coupled with the windings' terminals of the stator, and the lower face thereof works as a mounting terminal for being mounted with the device board by re-flow soldering.

[0029]

The motor-base detailed above is a part of a completed motor; however, the present invention preferably handles the motor-base including a metal frame outside thereof, i.e. motor-base-holder 4001, when the motor is assembled, as shown in Fig. 4. Metal frame 4101 shapes in a rectangle with fallen-out section in the center like a picture frame. Motor base 3101 is disposed at the center of holder 4001. Metal frame 4101 has six bridges

4201 which are arranged in radial at approx. the same intervals around base 3101. As such, the metal frame surrounds and holds the motor base. The motor base is separated off from the metal frame at perforations 4211 indicated with broken lines. Several round-holes 4301 are punched through the metal frame for positioning the holder.

[0030]

A process of assembling the motor using holder 4001 is demonstrated with reference to Fig. 5. First, place holder 4001 on an assembling machine by fitting round-holes 4301 to positioning pins 7101. Second, mate metal 3200 in bearing supporter 3141 of the motor-base. Third, insert stator 2000 into stator supporter 3151. Then press-fit bushing 3300 into stator fixer 3161. In this embodiment, the outer diameter of stator supporter 3151 is the same as that of stator fixer 3161. Bushing 3300 and stator fixer 3161 are manufactured to be tightly mated each other. Stator 2000 can be thus fixed to stator supporter just by press-fitting bushing 3300 into stator fixer 3161. After that, weld the windings' terminals of stator to the terminal of motor-base for completing the stator. A resistance-welding-machine, for instance, may be used in this case.

[0031]

The rotor has been assembled as shown in Fig. 5. A motor assembling machine chucks rotor frame 1100 vertically, and inserts shaft 1400 by centering metal 3200.

[0032]

Then cap the rotor with cup-shaped cover 3401. At this time, protrusions 3411 and 3421 extended from the end of cover 3401 are positioned at corresponding places on the motor-base. Protrusion 3421 is fixed to metal tip 3121 protruded from the motor-base by welding as shown in Fig. 2B. A laser-welding-machine may be used in this case.

[0033]

Finally, the motor base is cut off from the metal frame at the perforations. The motor thus assembled is shipped to the market after inspection and packaging. When the motor is inspected its performance, electrical conductivity between the motor-base terminals and the bridges is discontinued or the bridges are remained as common grounding terminals. Then the inspection can be done with the motor mounted on the metal frame.

[0034]

The motor in accordance with the first embodiment uses motor-base-holder 4001 linked with metal frame 4101 made of the same material as terminal 3111, and holder 4001 is disposed outside of motor base 3101. The metal frame made by punching a piece of metal plate together with the terminals positions motor base 3101. The insert-mold into the motor base is carried out with respect to round holes 4301 of the metal frame, the small size motor-base can be thus positioned much more precisely than a conventional method which sets positioning reference on a resin-made motor-base. The method of the present invention thus can deal with a micro motor which requires a precise mating allowance, and can realize to assemble the micro motor at high productivity.

[0035]

In the motor of this first embodiment, motor base 3101 is positioned together with base-holder 4001 and supported by bridges 4201. Bearing supporter 3141 protrudes vertically from an approx. center of the base, and metal 3200 is mounted to bearing supporter 3141, therefore, metal 3200 also protrudes from base 3101 with a certain distance. The bridges supporting the motor base is elastically deformed by lateral force. When the rotor is inserted into metal 3200, this structure produces centering action between shaft 1400 and metal 3200. This centering action contributes to high

productivity of assembling the micro motor.

[0036]

The motor in accordance with this first embodiment is a micro-flat-motor of 10 ㎜ across. The shaft of the motor is 0.8 ㎜ across and a clearance between the shaft and the metal (bearing) is max. several μm. This kind of accuracy is not only required by these elements but also by other elements. Automatic machines assemble those elements into a micro-motor at a high speed. Such an ultra-micro motor owes the high-speed assembly to the assembling method of the present invention, which allows quick handling of elements, highly accurate positioning, and an automatic centering action.

[0037]

In the first embodiment, trim 4401 is disposed between the bridges and picture-frame type metal frame. This trim 4401 functions as follows: The mounting terminals are disposed on the bottom face of the motor so that the device board can be soldered with the motor by re-flow soldering. However, the metal plate should be insulated and yet held, thus the metal plate must be insert-molded in the resin of the base. Therefore, the metal plate is inevitably shaped in a step-like form. In this case, trim 4401 allows less stress to remain in the metal plate, thus sections around the terminals and the metal frame are free from being abnormally deformed.

[0038]

In the first embodiment, a plurality of perforations 4211 are disposed around motor base 3101, and, more particularly, arranged at the same intervals around the motor base. This structure prevents the base from being supported unbalancedly, therefore, when a vertical external forces is applied, it directs the displacement in vertical direction. This does not lower the positioning accuracy for assembly. When a radial external force is applied to the bearing, it causes uniform elastic deformation in all directions.

Thus an excellent centering action is produced. As a result, an ultra-micro-motor can be assembled with high productivity.

[0039]

At least a plurality of perforations are arranged on both sides of a center line of the motor base so that the advantages discussed above can be obtained with ease. As will be discussed in a third embodiment, even if the perforations cannot be arranged uniformly in all directions for some reason, the perforations are preferably arranged around the motor-base to be rotationally symmetric.

[0040]

In the motor of this embodiment, stator core 2100 is inserted into stator supporter 3151, then bushing 3300 is press-fitted into stator fixer 3161, thereby fixing stator assembly 2000 to stator supporter 3151. Since only press-fitting of bushing 3300 can fix the stator assembly, the waiting-time after bonding or welding the stator can be saved. As a result, total assembly time can be shortened.

[0041]

Protrusions 3421 extended from the cover are fixed to metal tips 3121. This structure, i.e. connection between metals, yields a strong bonding force per unit area. Thus the bonding needs only a small space, and this is suitable for an ultra-micro-motor. The structure discussed above also allows the fringe of the cover to be electrically coupled with the metal tips. Accordingly, while the metal tip is electrically coupled with the mounting terminal, the metal tip is grounded to the device, thereby shielding electromagnetic noises produced by the motor.

[0042]

In the first embodiment, protrusions 3421 are welded to tips 3121, so that coagulating time of the welding is shorter than that for resin. As a

result, the total assembly time of the motor can be shortened. A protruded amount to outside the motor is less than that by engaging-deformation-fixing method which will be discussed in a fifth embodiment.

[0043]

(Exemplary Embodiment 2)

The second embodiment of the motor-base-holder is demonstrated hereinafter. Fig. 6 illustrates a motor-base-holder in accordance with the second exemplary embodiment of the present invention. Metal frame 4102 of motor-base-holder 4002 is formed by linking the metal frames used in the first embodiment together, and shapes in rectangular. Metal frame 4102 includes four pieces of motor-bases 3101. Six bridges 4202 are provided to each base 3101 and they are arranged in radial at approx. the same intervals. Round holes 4302 for positioning are provided more than a dozen in total on the metal frame.

[0044]

In the second embodiment, a plurality of motor-bases are linked together to form a rectangle. Since this holder holds a plurality of motor-bases simultaneously, better handling can be expected than holding a single base, and ultra-micro-motors can be handled with much ease. A positioning time at each step as well as an assembling time decreases at greater numbers of motor-base held by the holder. In this second embodiment, a rectangle containing several motor-bases or maximum not more than 20 motor-bases is handled. As far as the rectangle shape is kept, bending stress is not applied when the motor-base-holders are in storage. As a result, the motor-bases are not deformed by creep. This is different from a third embodiment discussed later because the third embodiment addresses a belt-like holder.

[0045]

(Exemplary Embodiment 3)

The third embodiment of the motor-base-holder is demonstrated hereinafter. Fig. 7 illustrates a motor-base-holder in accordance with the third exemplary embodiment of the present invention.

Metal frame 4103 of motor-base-holder 4003 extends long to form a belt. Frame 4103 contains numbers of motor-bases 3101. Four bridges 4203 (two bridges per side) are provided to each base 3101, this is different from that of the second embodiment. The motor bases are linked to the metal frame at both the sides of the frame in width direction of the belt. Round holes 4303 for positioning are sequentially provided on frame 4103.

[0046]

In the third embodiment, as discussed above, fringes of plurality of motor-bases are linked by the metal frame, thereby forming a belt. This structure allows the motor-base to be transferred with the metal frame in sequence, so that the motors can be continuously assembled. This structure thus can simplify a transferring mechanism, and allows assembly equipment to be compact and inexpensive. As a result, an inexpensive motor can be manufactured with high productivity.

[0047]

Adjacent motor-bases in the holder of this third embodiment are separated in the longitudinal direction of the belt. When the belt-like holder is wound on a reel, the motor-base which is insert-molded is free from bending stress. Since creep is prevented from occurring on the resin in storage of the motor-bases, resin-mold products are not degraded their accuracy in shape. A number of bridges is preferably not more than three on one side. If more than two bridges are provided on one side, bending stress tends to occur in the motor-base when the metal frame warps.

[0048]

(Exemplary Embodiment 4)

Fig. 8 illustrates a motor-base-holder in accordance with the fourth exemplary embodiment of the present invention.

Metal frames 4104 of motor-base-holders 4004 are linked with each other to form a belt. However, the metal frame used in the first embodiment is not just linked in the longitudinal direction, but the metal frame is linked with the sections that form both sides of the belt. Six bridges 4204 are provided to each base 3101 as same as the first embodiment and support the base uniformly.

[0049]

The adjacent motor-bases held by this holder are separated in the longitudinal direction. The resin-made motor bases are thus prevented from creep in storage, and resin-mold products are not degraded accuracy in shape. Further, each motor base is supported its surrounding evenly, so that the uniform centering action in all directions is obtainable.

[0050]

(Exemplary Embodiment 5)

The fifth embodiment of the present invention is demonstrated hereinafter. Fig. 9 is a partial lateral view illustrating how a motor cover is fixed to the motor base.

[0051]

In this embodiment, protrusions 3422, disposed at the end of cover 3402, extend in a radial direction outwardly. On the other hand, metal tips extended from a motor base are folded so that the tips can clip protrusions 3422.

[0052]

In this fifth embodiment, the end of cover and the metal tips of motor base are engaged and deformed to fix each other. Metal is easy to deform

flexibly and it maintains the strength after deformation. Therefore, the metal can be bonded with a small area, and this is suitable for an ultra-micro-motor. The fixation by this engaging-deformation needs not the time before solidification, while heat-resin-bonding requires some time for solidification. As a result, assembly time of the motor can be shortened.

[0053]

Several exemplary embodiments of the present invention have been demonstrated; however, the present invention is not limited to these embodiments but various applications are available within the scope of the invention. The present invention is good for ultra-micro-motors as discussed in the embodiments; however, it is also applicable to various kinds of motors. Round holes used for positioning are disposed on the metal frame on both sides; however, the round holes may be disposed on one side.

[0054]

[Advantages of the Invention]

As discussed above, the present invention solves the difficulty of handling motors, difficulty of mating elements of the motors, time-consuming bonding, and provides a motor allowing high productivity as well as a method of assembling the same motor.

[Brief Descriptions of the Drawings]

Fig. 1 is a cross section illustrating a structure of a motor in accordance with a first exemplary embodiment of the present invention.

Fig. 2 shows an appearance of the motor shown in Fig. 1.

Fig. 2(a) is a top view of the same motor as shown in Fig. 1.

Fig. 2(b) is a side view of the same motor as shown in Fig. 1.

Fig. 2(c) is a bottom view of the same motor as shown in Fig. 1.

Fig. 3 shows an appearance of a motor-base of the motor in Fig. 1.

Fig. 3(a) is a plan view of the motor base of the motor shown in Fig. 1.

Fig. 3(b) is a side view of the motor base of the motor shown in Fig. 1.

Fig. 4 is a plan view of a motor-base-holder of the motor in Fig. 1.

Fig. 5 is an exploded lateral view of components constituting the motor shown in Fig. 1.

Fig. 6 illustrates a motor-base-holder in accordance with a second exemplary embodiment of the present invention.

Fig. 7 illustrates a motor-base-holder in accordance with a third exemplary embodiment of the present invention.

Fig. 8 illustrates a motor-base-holder in accordance with a fourth exemplary embodiment of the present invention.

Fig. 9 is a partial lateral view illustrating how a motor cover is fixed to the motor base in accordance with another exemplary embodiment of the present invention.

Fig. 10 is a cross section illustrating a structure of a conventional motor.

[Description of the Reference Marks]

2000 stator assembly

3101 motor base

3111 terminal

3121 metal tip

3131 base

3141 bearing supporter

3151 stator supporter

3161 stator fixer

3300 bushing

3401, 3402 cover

3411, 3421, 3422 protrusion

4001, 4002, 400., 4004 motor-base-holder

4101, 4102, 4103, 4104 metal frame

4201, 4202, 4203, 4204 bridge

4211 perforations

5 4301, 4302, 4303 round hole

4401 trim

7101 positioning pin

[Name of Document] Abstract

[Abstract]

[Object] The present invention aims to provide a motor having a structure allowing high productivity as well as a method of assembling the same motor by solving problems such as difficulty of handling, severity of mating, time-consuming of bonding or welding.

[Means to Solve the Problems] A motor-base-holder, formed of motor-base 3101 and metal frame 4101 made of the same material as a terminal, and frame 4101 being linked with fringes of base 3101, is used for assembling a brush-less motor. The motor discussed above is assembled through the following steps:

positioning and supporting motor base 3101 of motor-base-holder 4001 by metal frame 4101;

assembling the stator assembly and the rotor to the motor base; and

detaching the motor base from metal frame 4101.

[Selected Drawing] Fig. 4

[Name of the document] Drawing

Fig. 1

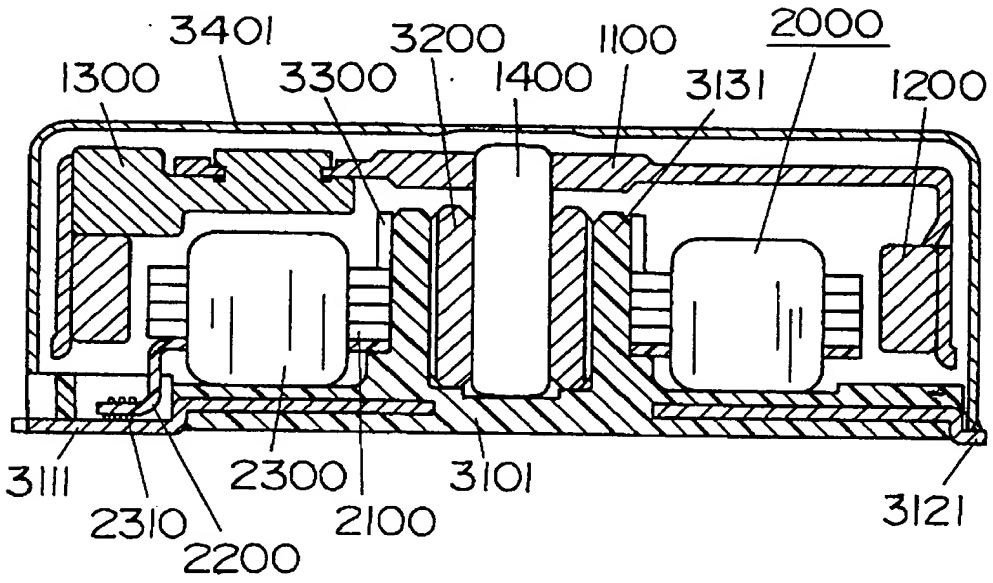


Fig. 2

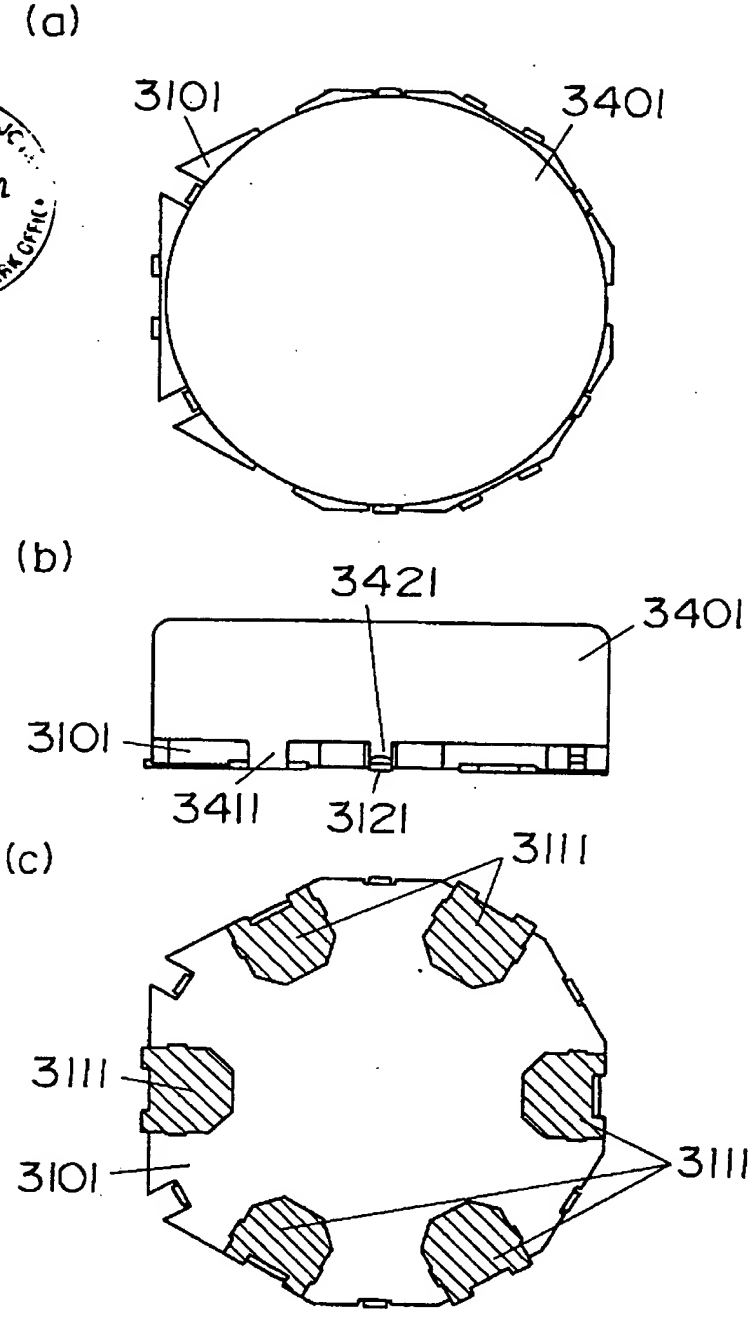
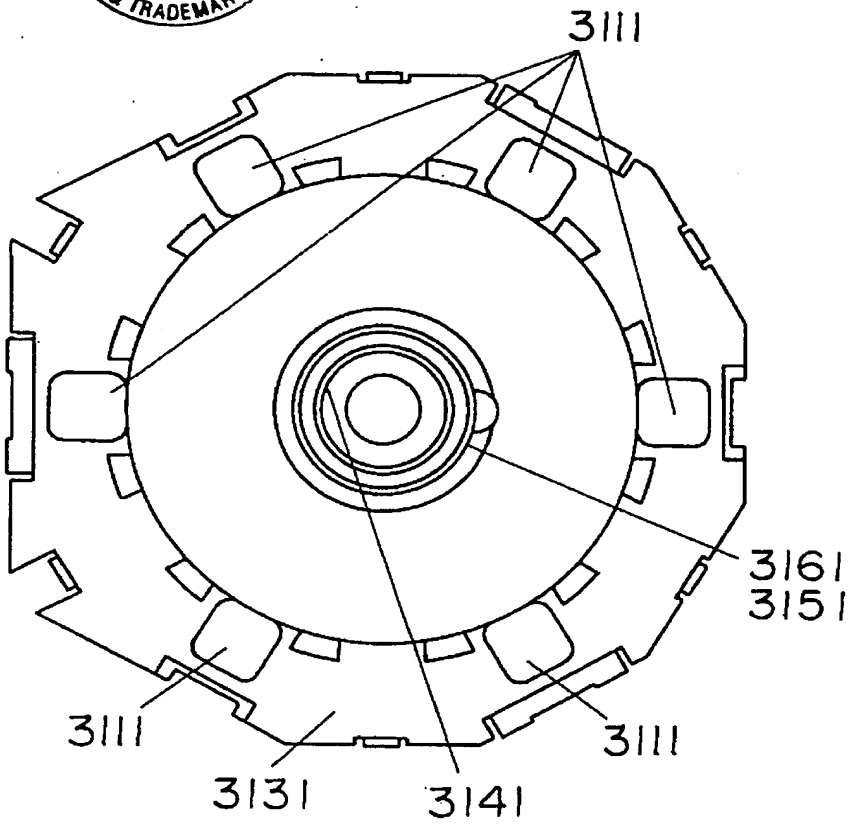


Fig. 3

3101

(a)



(b)

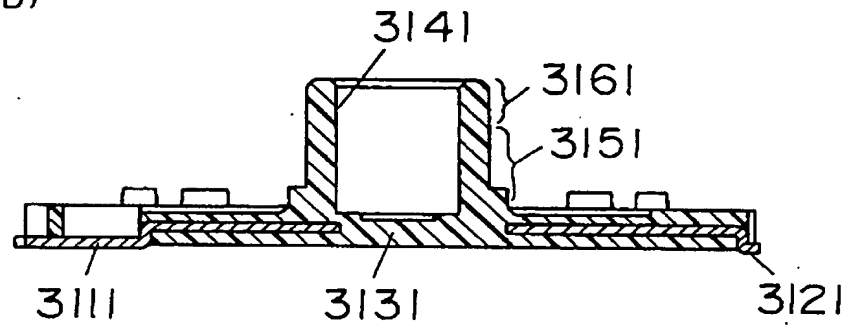


Fig. 4

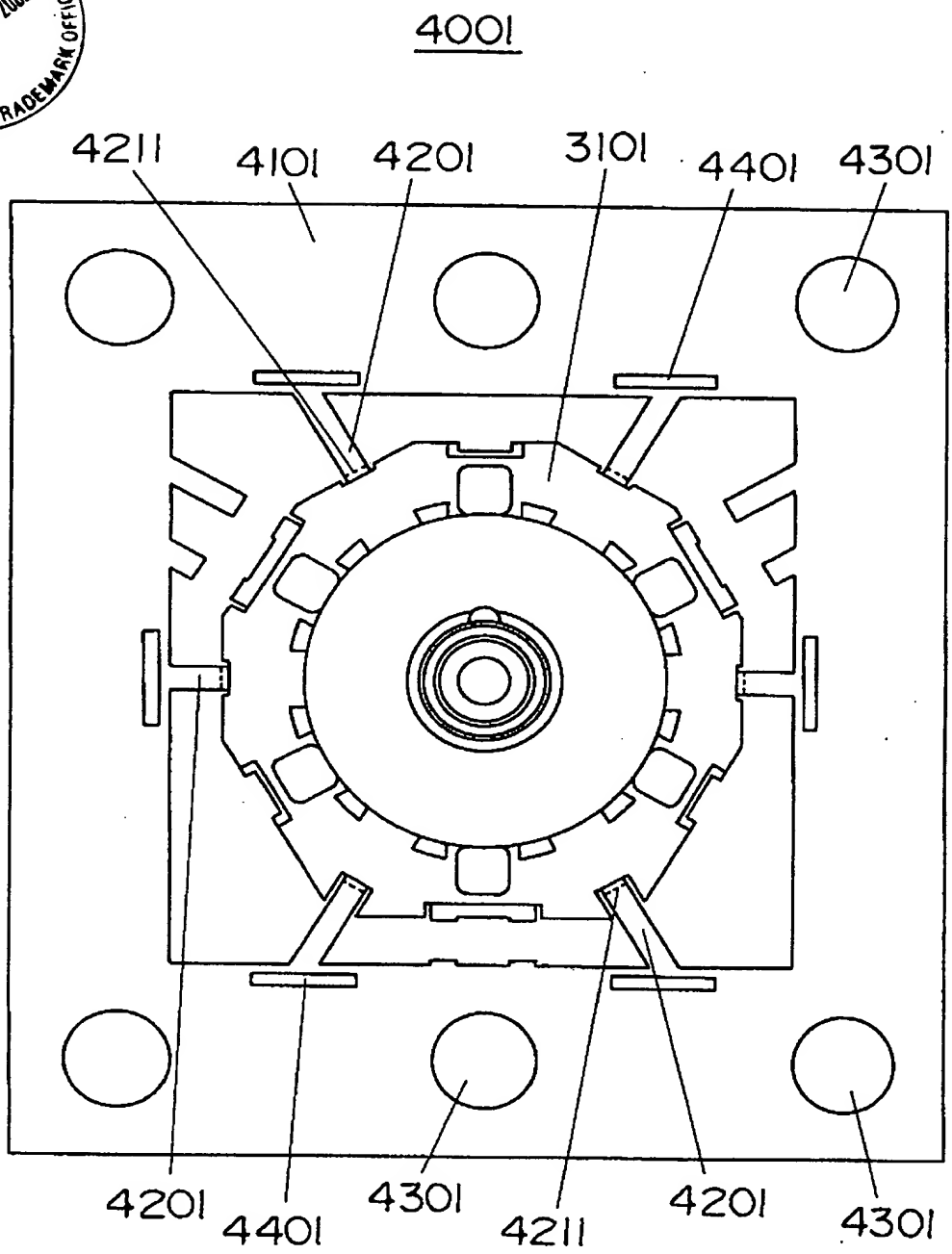


Fig. 5

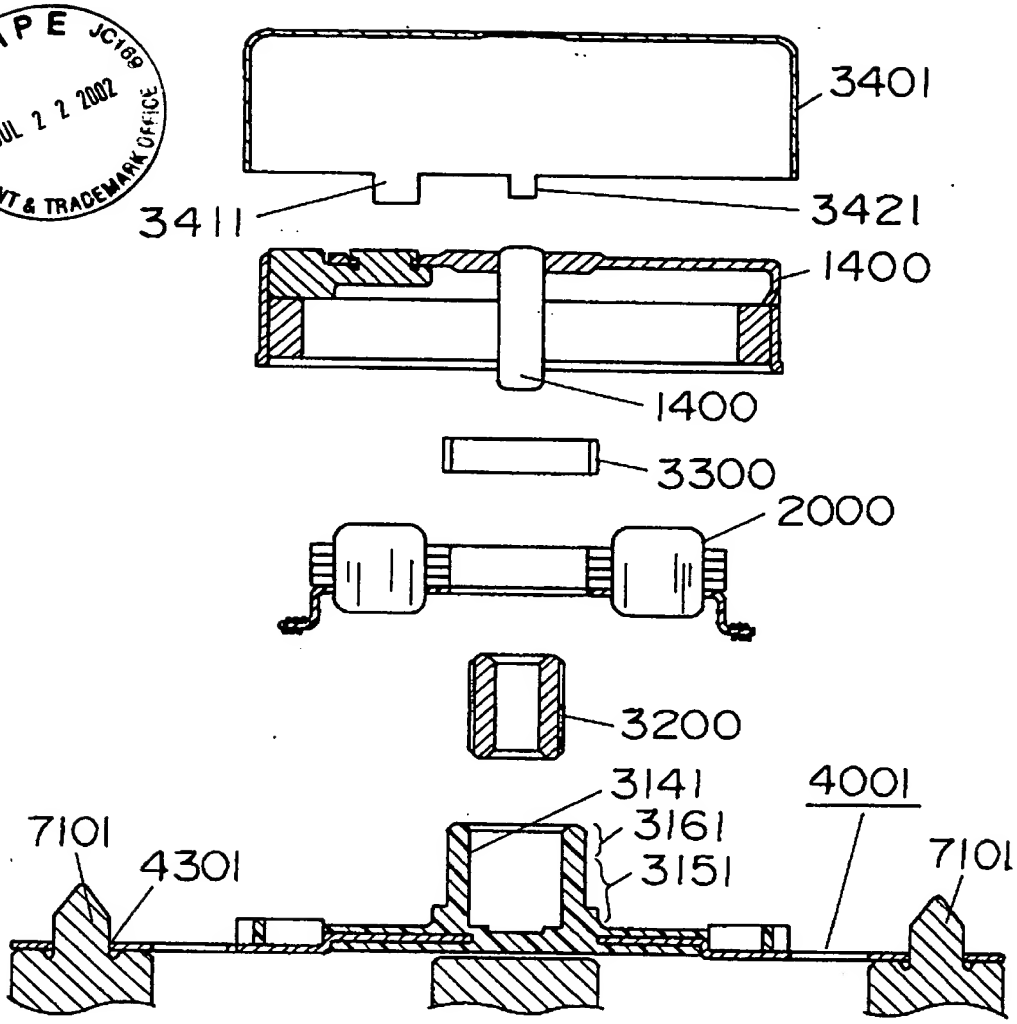


Fig. 6

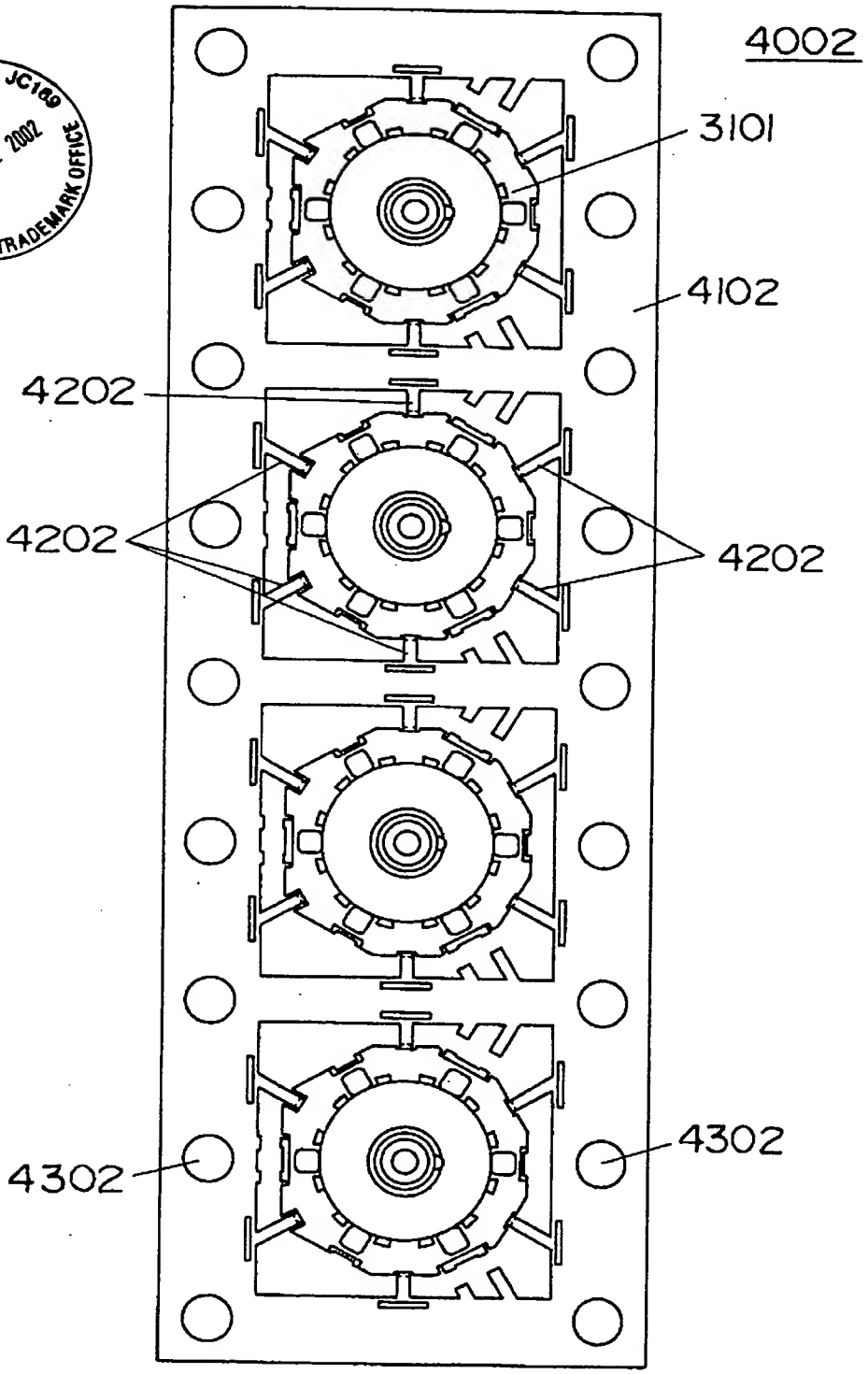


Fig. 7

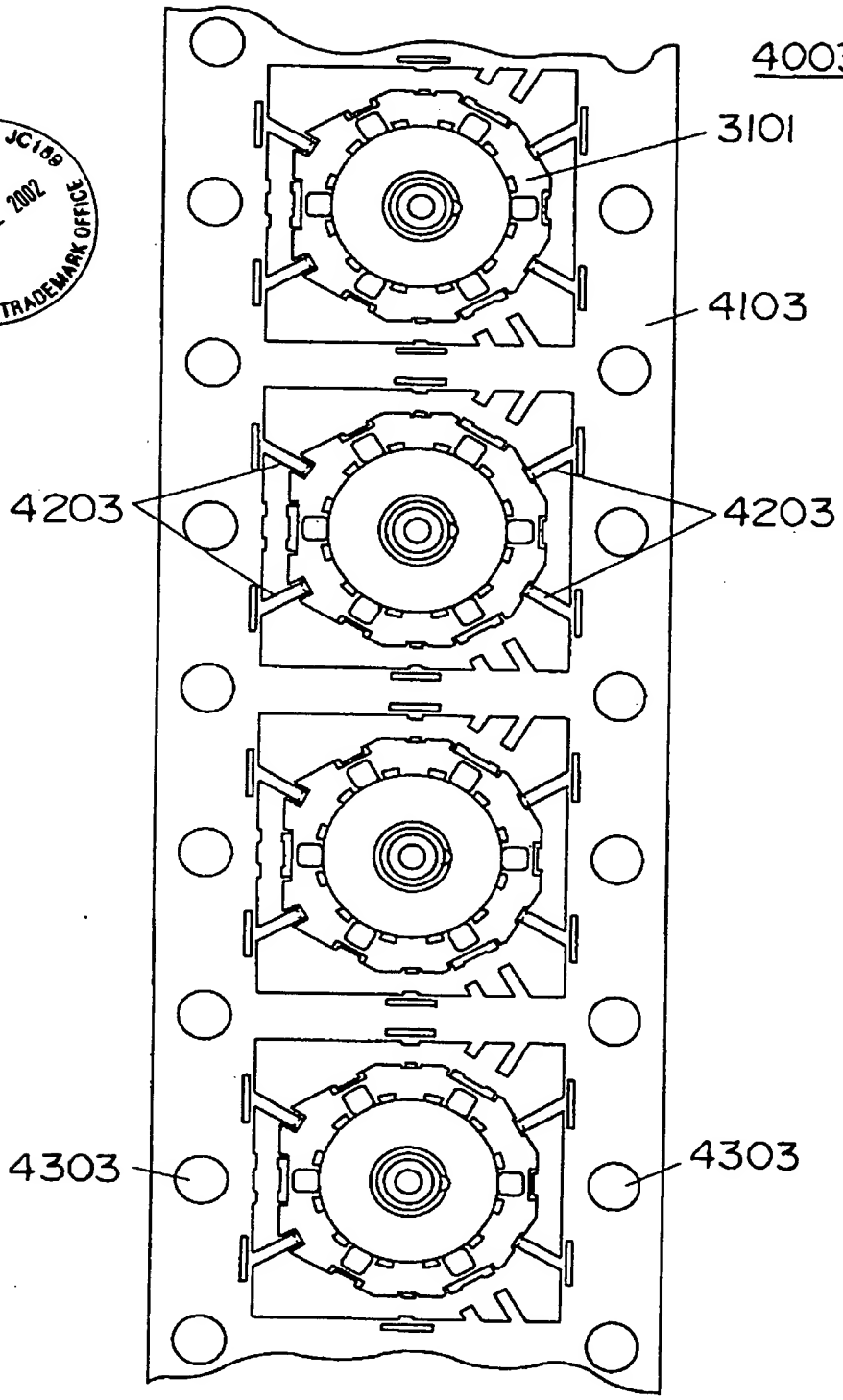


Fig. 8

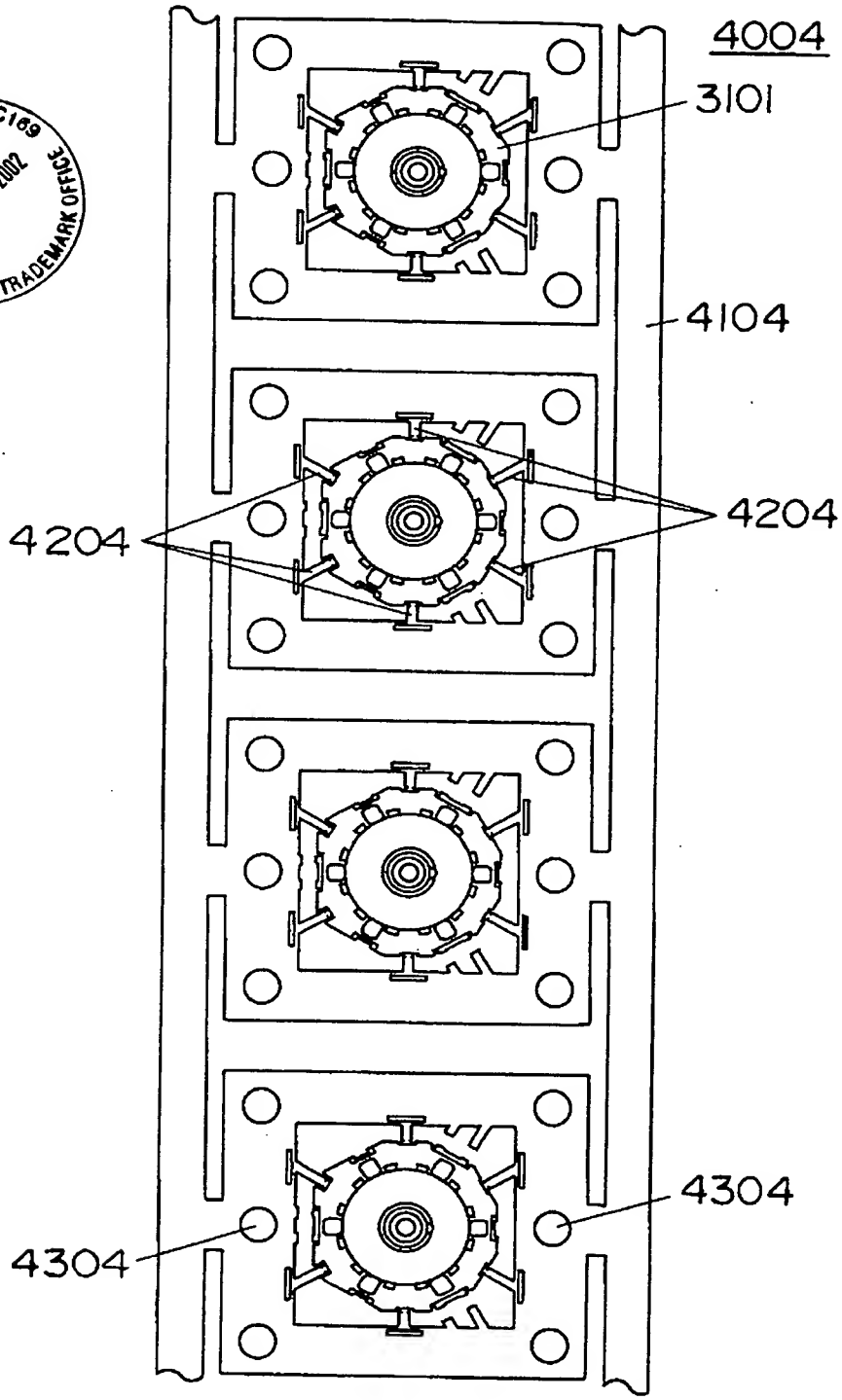


Fig. 9

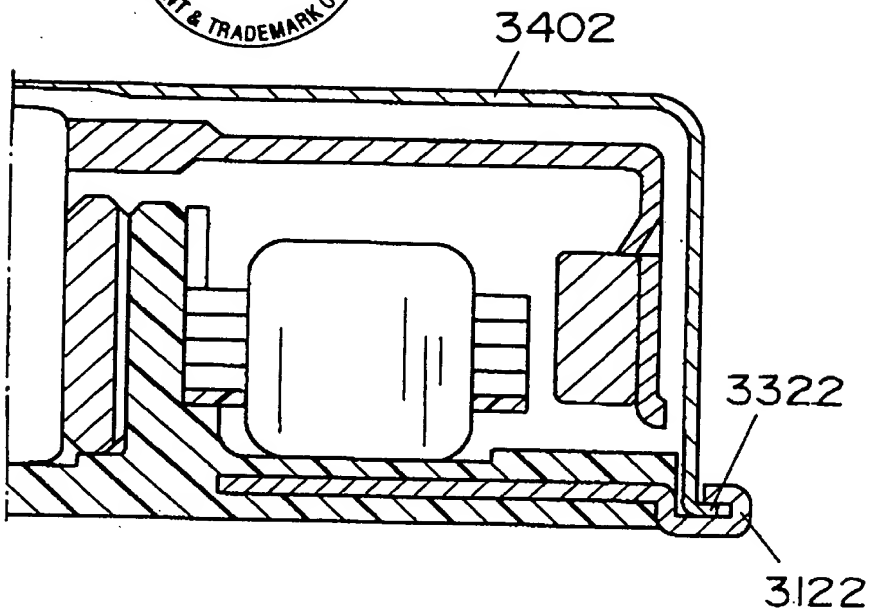


Fig. 10